Specifications describe the instrument’s warranted performance over the temperature range of 0 °C to 40 °C (except as noted). Supplemental characteristics are intended to provide information that is useful in applying the instrument by giving non-warranted performance parameters. These are denoted as SPC (supplemental performance characteristics), typical, or nominal. Warm up time must be greater than or equal to 30 minutes after power on for all specifications.

Source characteristics
Frequency characteristics (Option 4395A-800)

<table>
<thead>
<tr>
<th>Range</th>
<th>10 Hz to 500 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>1 mHz</td>
</tr>
</tbody>
</table>

Frequency reference

- Accuracy: at 23 °C ± 5 °C, referenced to 23 °C ≤ ±5.5 ppm
- Aging: ≤ ±2.5 ppm/year (SPC)
- Initial achievable accuracy: ≤ ± 1.0 ppm (SPC)
- Temperature stability: at 23 °C ± 5 °C, referenced to 23 °C ≤ ±2 ppm (SPC)

Precision frequency reference (Option 4395A-1D5)

- Accuracy: at 0 °C to 40 °C, referenced to 23 °C ≤ ±0.13 ppm
- Aging: ≤ ±0.1 ppm/year (SPC)
- Initial achievable accuracy: ≤ ±0.02 ppm (SPC)
- Temperature stability: at 0 °C to 40 °C, referenced to 23 °C ≤ ±0.01 ppm (SPC)

Output characteristics

- Power range: -50 dBm to +15 dBm
- Level accuracy: at 0 dBm output, 50 MHz, 23 °C ± 5 °C, ≤ ±1.0 dB

Level linearity

<table>
<thead>
<tr>
<th>Output power</th>
<th>Linearity1</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ -40 dBm</td>
<td>±1.0 dB</td>
</tr>
<tr>
<td>&lt; -40 dBm</td>
<td>±1.5 dB</td>
</tr>
</tbody>
</table>

1. At relative to 0 dBm output, 50 MHz, 23 °C ± 5 °C
Flatness
at 0 dBm output, relative to 50 MHz, 23 °C ± 5 °C .................. ±2 dB

Resolution .................................................. 0.1 dB

Spectral purity characteristics

Harmonics
at +10 dBm output .............................................. < –30 dBc

Non-harmonics spurious
at +10 dBm output .............................................. < –30 dBc

Noise sidebands
at ≥ 10 kHz offset from carrier ............................. < –95 dBc/Hz

Power sweep range ........................................... 20 dB max.

Power sweep linearity
development from linear power referenced to the stop power level ........ ±0.5 dB

Impedance ................................................. 50 Ω nominal

Return loss
frequency ≤ 200 MHz ........................................ > 15 dB (SPC)
frequency > 200 MHz ......................................... > 7 dB (SPC)

Connector .................................................. Type N female
## Receiver Characteristics

### Input characteristics

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>10 Hz to 500 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input attenuator</td>
<td>0 to 50 dB, 10 dB step</td>
</tr>
</tbody>
</table>

### Full scale input level (R, A, B)

<table>
<thead>
<tr>
<th>Attenuator setting (dB)</th>
<th>Full scale input level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-10 dBm</td>
</tr>
<tr>
<td>10</td>
<td>0 dBm</td>
</tr>
<tr>
<td>20</td>
<td>+10 dBm</td>
</tr>
<tr>
<td>30</td>
<td>+20 dBm</td>
</tr>
<tr>
<td>40</td>
<td>+30 dBm</td>
</tr>
<tr>
<td>50</td>
<td>+30 dBm</td>
</tr>
</tbody>
</table>

### IF bandwidth (IFBW)

2, 10, 30, 100, 300, 1 k, 3 k, 10 k, 30 kHz

*Note: The IFBW should be set to less than 1/5 of the lowest frequency in the sweep range.*

### Noise level (referenced to full scale input level, 23 °C ± 5 °C)

- At 10 Hz ≤ frequency < 100 Hz, IFBW = 2 Hz: \(-85 \text{ dB (SPC)}\)
- At 100 Hz ≤ frequency < 100 kHz, IFBW = 10 Hz: \(-85 \text{ dB (SPC)}\)
- At 100 kHz ≤ frequency, IFBW = 10 Hz: \(-115 \text{ dB (SPC)}\)

### Input crosstalk

- For input R + 10 dBm input, input attenuator: 20 dB
- For input A, B input attenuator: 0 dB

  - At < 100 kHz:
    - R through A, B: \(< -100 \text{ dB (SPC)}\)
    - Others: \(< -100 \text{ dB (SPC)}\)
  - At ≥ 100 kHz:
    - R through A, B: \(< -120 \text{ dB (SPC)}\)
    - Others: \(< -120 \text{ dB (SPC)}\)

### Source crosstalk (for input A, B) (typical for input R)

- At +10 dBm output, < 100 kHz, input attenuator: 0 dB: \(< -100 \text{ dB (SPC)}\)
- At +10 dBm output, ≥100 kHz, input attenuator: 0 dB: \(< -120 \text{ dB (SPC)}\)

### Multiplexer switching impedance change

- At input attenuator 0 dB: \(< 0.5\% \text{ (SPC)}\)
- At input attenuator 10 dB and above: \(< 0.1\% \text{ (SPC)}\)

### Connector

Type-N female

### Impedance

50 Ω nominal

### Return loss

<table>
<thead>
<tr>
<th>Input attenuator</th>
<th>0 dB</th>
<th>10 dB</th>
<th>20 dB to 50 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Hz ≤ frequency &lt; 100 kHz</td>
<td>25 dB(^1)</td>
<td>25 dB(^1)</td>
<td>25 dB(^1)</td>
</tr>
<tr>
<td>100 kHz ≤ frequency ≤ 100 MHz</td>
<td>25 dB(^1)</td>
<td>25 dB</td>
<td>25 dB(^1)</td>
</tr>
<tr>
<td>100 MHz &lt; frequency</td>
<td>15 dB(^1)</td>
<td>15 dB</td>
<td>15 dB(^1)</td>
</tr>
</tbody>
</table>

### Maximum input level

+30 dBm (at input attenuator: 40 dB or 50 dB)

### Maximum safe input level

+30 dBm or ±7 Vdc (SPC)

\(^1\) SPC
Magnitude Characteristics

Absolute amplitude accuracy (R, A, B)
at –10 dBm input, input attenuator:
10 dB, frequency ≥ 100 Hz, IFBW ≤ 3 kHz, 23 °C ± 5 °C, ............... < ±1.5 dB

Ratio accuracy (A/R, B/R) (typical for A/B)
at –10 dBm input, input attenuator:
10 dB, IFBW ≤ 3 kHz, 23 °C ± 5 °C, ................................. < ±2 dB

Dynamic accuracy (A/R, B/R) (typical for A/B)

<table>
<thead>
<tr>
<th>Input level (relative to full scale input level)</th>
<th>Dynamic accuracy1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 dB ≥ input level &gt; –10 dB</td>
<td>±0.4 dB</td>
</tr>
<tr>
<td>–10 dB ≥ input level ≥ –60 dB</td>
<td>±0.05 dB</td>
</tr>
<tr>
<td>–60 dB &gt; input level ≥ –80 dB</td>
<td>±0.3 dB</td>
</tr>
<tr>
<td>–80 dB &gt; input level ≥ –100 dB</td>
<td>±3 dB</td>
</tr>
</tbody>
</table>

Figure 1-1. Magnitude dynamic accuracy

Residual responses .............................................. < –80 dB full scale (SPC)

Trace noise (A/R, B/R, A/B)
at 50 MHz, both inputs:
full scale input level –10 dB, IFBW = 300 Hz ................................. < 0.005 dB rms (SPC)

Stability (A/R, B/R, A/B) ....................................... < ±0.01 dB/°C (SPC)

Phase characteristics

Measurements format .......................................... Standard format, expanded phase format

Frequency response (deviation from linear phase) (A/R, B/R) (SPC for A/B)
at –10 dBm input, input attenuator: 10 dB, IFBW ≤ 3 kHz, 23 °C ± 5 °C ............ < ±12°

Dynamic accuracy (A/R, B/R) (SPC for A/B)

<table>
<thead>
<tr>
<th>Input level (relative to full scale input level)</th>
<th>Dynamic accuracy1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 dB ≥ input level &gt; –10 dB</td>
<td>±3°</td>
</tr>
<tr>
<td>–10 dB ≥ input level ≥ –60 dB</td>
<td>±0.3°</td>
</tr>
<tr>
<td>–60 dB &gt; input level ≥ –80 dB</td>
<td>±1.8°</td>
</tr>
<tr>
<td>–80 dB &gt; input level ≥ –100 dB</td>
<td>±18°</td>
</tr>
</tbody>
</table>

1. R input level (B input level for A/B) = full scale input level –10 dB, IFBW = 10 Hz, 23 °C ± 5 °C
Figure 1-2. Phase dynamic accuracy

Trace noise (A/R, B/R, A/B)
at 50 MHz, both inputs:
full scale input level –10 dB, IFBW = 300 Hz .................< 0.04° rms (SPC)
Stability (A/R, B/R, A/B) .........................< ±0.1 °/°C (SPC)

Group delay characteristics
Aperture [Hz] ........................................... 0.25% to 20% of span
Accuracy
In general, the following formula can be used to determine the accuracy, in seconds,
of a specific group delay measurement:

\[
\text{Phase accuracy (degree)} = \frac{\text{Aperture (Hz)} \times 360 \text{ (degree)}}{\text{Aperture (Hz)}}
\]

Sweep characteristics
Sweep type ......................... Linear frequency, log frequency, power, list frequency
Sweep direction ..................... Upper direction only
Trigger type ......................... Hold, single, number of groups, continuous
Trigger source ....................... Internal (free run), external, manual, GPIB (bus)
Event trigger ......................... On point, on sweep
Spectrum Measurement

Frequency characteristics

Frequency range .................................................10 Hz to 500 MHz

Frequency readout accuracy
.................................\( \pm f_{\text{freq readout}} \times (f_{\text{freq ref accuracy}} + \frac{\text{SPAN}[\text{Hz}]}{\text{NOP}-1}) \) [Hz]

where NOP means number of display points

Frequency reference (Option 4395A-800)

Accuracy
at 23 °C ± 5 °C, referenced to 23 °C ..................... < ±5.5 ppm

Aging .............................................................. < ±2.5 ppm/year (SPC)

Initial achievable accuracy .................................. < ± 1.0 ppm (SPC)

Temperature stability
at 23 °C ± 5 °C, referenced to 23 °C ..................... < ±2 ppm (SPC)

Precision frequency reference (Option 4395A-1D5)

Accuracy
at 0 °C to 40 °C, referenced to 23 °C ..................... < ±0.13 ppm

Aging .............................................................. < ±0.1 ppm/year (SPC)

Initial achievable accuracy .................................. < ±0.02 ppm (SPC)

Temperature stability
at 0 °C to 40 °C, referenced to 23 °C ..................... < ±0.01 ppm (SPC)

Resolution bandwidth (RBW)

Range
3 dB RBW at span > 0 ......................... 1 Hz to 1 MHz, 1-3 step
3 dB RBW at span = 0 ...
...................3 kHz, 5 kHz, 10 kHz, 20 kHz, 40 kHz, 100 kHz, 200 kHz, 400 kHz, 800 kHz, 1.5 MHz, 3 MHz, 5 MHz

Selectivity (60 dB BW/3 dB BW)

Mode .............................................................. Auto or manual

Accuracy
at span > 0 ............................................... < ±10%

at span = 0 ............................................... < ±30%

Video bandwidth (VBW)

Range
at span > 0 ........................................ 3 MHz to 3 MHz, 1-3 step, 0.003 \( \leq \frac{\text{VBW}}{\text{RBW}} \leq 1 \)

Noise sidebands

<table>
<thead>
<tr>
<th>Offset from carrier</th>
<th>Noise sidebands</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \geq 1 \text{ kHz} )</td>
<td>(-95 \text{ dBc/Hz})</td>
</tr>
<tr>
<td>( \geq 100 \text{ kHz} )</td>
<td>(-108 \text{ dBc/Hz})</td>
</tr>
</tbody>
</table>

![Figure 1-3. Noise sidebands](image-url)
Amplitude Characteristics

Amplitude range ........................................ displayed average noise level to +30 dBm
Reference value setting range ............................. −100 dBm to +30 dBm

Level accuracy
at −20 dBm input, 50 MHz, input attenuator: 10 dB, 23 °C ± 5 °C ........... < ±0.8 dB

Frequency response
at −20 dBm input, input attenuator: 10 dB, referenced to level at 50 MHz, 23 °C ± 5 °C
frequency ≥ 100 Hz ............................................. < ±1.5 dB
frequency < 100 Hz ............................................. < ±1.3 dB

Amplitude fidelity1

<table>
<thead>
<tr>
<th>Range (dB to reference input level [dB])</th>
<th>Amplitude fidelity [dB]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to −30</td>
<td>±0.05</td>
</tr>
<tr>
<td>−30 to −40</td>
<td>±0.07</td>
</tr>
<tr>
<td>−40 to −50</td>
<td>±0.15</td>
</tr>
<tr>
<td>−50 to −60</td>
<td>±0.35</td>
</tr>
<tr>
<td>−60 to −70</td>
<td>±0.8</td>
</tr>
<tr>
<td>−70 to −80</td>
<td>±1.8</td>
</tr>
</tbody>
</table>

Linear scale2 ........................................................................................................... < ±3%

Displayed average noise level
at reference value ≤ −40 dBm, input attenuator: auto or 0 dB
at frequency ≥1 kHz ................................................. −120 dBm/Hz
at ≥ 100 kHz ............................................................. −133 dBm/Hz
at ≥ 10 MHz ......................................................... (−145 + frequency/100 MHz) dBm/Hz3

Figure 1-4. Typical displayed average noise level

---

1. Fidelity shows an extent of nonlinearity referenced to the reference input level.
2. RBW = 10 Hz, −20 dBm ≤ reference value ≤ +30 dBm, reference input level = full scale input level −10 dB, 23 ± 5 °C
3. At start frequency ≥ 10 MHz

Note: Refer to Input attenuator part for the definition of full scale input level.
On-screen Dynamic Range

Figure 1-5. Typical on-screen dynamic range (center: 100 MHz)

Spurious responses

Second harmonic distortion
at single tone input with full scale input level $-10$ dB, input signal frequency $\geq 100$ kHz
\[ \leq -70 \text{ dBc}, \leq -75 \text{ dBc (SPC)} \]

Third order inter-modulation distortion
at two tones input with full scale input level $-16$ dB, separation $\geq 100$ kHz
\[ \leq -75 \text{ dBc}, \leq 80 \text{ dBc (SPC)} \]

Spurious
at single tone input with full scale input level $-10$ dB, input signal frequency $\leq 500$ MHz
\[ \leq -75 \text{ dBc} \]
except for the following frequency ranges:
5.6 MHz ± 1 MHz, 30.6 MHz ± 1 MHz, 415.3 MHz ± 1 MHz

Residual response
at reference value setting $\leq -40$ dBm, input attenuator: auto or 0 dB \[ \leq -110 \text{ dBm} \]
**Typical Dynamic Range**

![Figure 1-6. Typical dynamic range at inputs R, A, and B](image)

**Input attenuator**

<table>
<thead>
<tr>
<th>Attenuator setting (dB)</th>
<th>Full scale input level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-20 dBm</td>
</tr>
<tr>
<td>10</td>
<td>-10 dBm</td>
</tr>
<tr>
<td>20</td>
<td>0 dBm</td>
</tr>
<tr>
<td>30</td>
<td>+10 dBm</td>
</tr>
<tr>
<td>40</td>
<td>+20 dBm</td>
</tr>
<tr>
<td>50</td>
<td>+30 dBm</td>
</tr>
</tbody>
</table>

**Mode**

Auto or manual

(In auto mode, the attenuator is set to 20 dB above the reference value; this ensures that the maximum signal level after the attenuator will not be greater than -20 dBm.)

**Input attenuator switching uncertainty**

at attenuator: ≤ 30 dB, referenced to 10 dB  
< ±1.0 dB

at attenuator: ≥ 40 dB, referenced to 10 dB  
< ±1.5 dB

**Temperature drift**

< ±0.05 dB/°C (SPC)

**Scale**

Log 0.1 dB/div to 20 dB/div

Linear

at watt: 1.0 x 10^{-12} W/div

at volt: 1.0 x 10^{-9} V/div

**Measurement format**

Spectrum or noise (/Hz)

**Display unit**

dBm (unit of marker: dBm, dBV, dBµV, V, W)

**Sweep characteristics**

**Sweep type**

Linear, list

**Trigger type**

Hold, single, number of groups, continuous

**Trigger source**

Internal (free run), external, manual, level gate, edge gate, GPIB (bus)

**Sweep time** (excluding each sweep setup time)

<table>
<thead>
<tr>
<th>RBW</th>
<th>SPAN</th>
<th>Typical sweep time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 MHz</td>
<td>500 MHz</td>
<td>190 ms</td>
</tr>
<tr>
<td>100 kHz</td>
<td>100 MHz</td>
<td>300 ms</td>
</tr>
<tr>
<td>10 kHz</td>
<td>10 MHz</td>
<td>240 ms</td>
</tr>
<tr>
<td>1 kHz</td>
<td>1 MHz</td>
<td>190 ms</td>
</tr>
<tr>
<td>100 Hz</td>
<td>100 kHz</td>
<td>270 ms</td>
</tr>
<tr>
<td>10 Hz</td>
<td>10 kHz</td>
<td>2.0 s</td>
</tr>
<tr>
<td>1 Hz</td>
<td>1 kHz</td>
<td>11 s</td>
</tr>
</tbody>
</table>

1. See the next item for sweep time at zero span
### Zero span

<table>
<thead>
<tr>
<th>RBW</th>
<th>Minimum resolution</th>
<th>Maximum sweep time</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 MHz</td>
<td>40 ns</td>
<td>1.28 ms</td>
</tr>
<tr>
<td>100 kHz</td>
<td>1.28 µs</td>
<td>81.92 ms</td>
</tr>
<tr>
<td>3 kHz</td>
<td>40.96 µs</td>
<td>2.62 s</td>
</tr>
</tbody>
</table>

### Number of display points

- at span > 0: 2 to 801 points (automatically set)
- at span = 0: 2 to 801 points (Selectable)

### Input characteristics

#### Input port
- R, A, B

#### Crosstalk
- From any input to other inputs, at the same input attenuator settings: < -100 dB (SPC)

#### Connector
- Type N female

#### Impedance
- 50 Ω nominal

#### Return loss

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Input attenuator 0 dB</th>
<th>Input attenuator 10 dB</th>
<th>Input attenuator 20 dB to 50 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Hz ≤ frequency &lt; 100 kHz</td>
<td>25 dB¹</td>
<td>25 dB¹</td>
<td>25 dB¹</td>
</tr>
<tr>
<td>100 kHz ≤ frequency ≤ 100 MHz</td>
<td>25 dB¹</td>
<td>25 dB</td>
<td>25 dB¹</td>
</tr>
<tr>
<td>100 MHz &lt; frequency</td>
<td>15 dB¹</td>
<td>15 dB</td>
<td>15 dB¹</td>
</tr>
</tbody>
</table>

#### Input level
- +30 dBm max. at input attenuator: 50 dB

#### Maximum safe input level
- +30 dBm or ±7 Vdc (SPC)
Specifications when Option 4395A-1D6
Time-Gated Spectrum Analysis is Installed

All specifications are identical to the standard Agilent 4395A except the following items.

<table>
<thead>
<tr>
<th>Gate length</th>
<th>Range</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>6 µs to 3.2 s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range of gate length (T_i)</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 µs ≤ T_i ≤ 25 ms</td>
<td>0.4 µs</td>
</tr>
<tr>
<td>25 ms &lt; T_i ≤ 64 ms</td>
<td>1 µs</td>
</tr>
<tr>
<td>64 ms &lt; T_i ≤ 130 ms</td>
<td>2 µs</td>
</tr>
<tr>
<td>130 ms &lt; T_i ≤ 320 ms</td>
<td>5 µs</td>
</tr>
<tr>
<td>320 ms &lt; T_i ≤ 1.28 s</td>
<td>20 µs</td>
</tr>
<tr>
<td>1.28 s &lt; T_i ≤ 3.2 s</td>
<td>100 µs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gate length</th>
<th>Range</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2 µs to 3.2 s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range of gate delay (T_d)</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 µs ≤ T_d ≤ 25 ms</td>
<td>0.4 µs</td>
</tr>
<tr>
<td>25 ms &lt; T_d ≤ 64 ms</td>
<td>1 µs</td>
</tr>
<tr>
<td>64 ms &lt; T_d ≤ 130 ms</td>
<td>2 µs</td>
</tr>
<tr>
<td>130 ms &lt; T_d ≤ 320 ms</td>
<td>5 µs</td>
</tr>
<tr>
<td>320 ms &lt; T_d ≤ 1.28 s</td>
<td>20 µs</td>
</tr>
<tr>
<td>1.28 s &lt; T_d ≤ 3.2 s</td>
<td>100 µs</td>
</tr>
</tbody>
</table>

Additional amplitude error
Log scale < 0.3 dB (SPC)
Linear scale < 3% (SPC)

Gate control modes Edge (positive/negative) or level

Gate trigger input (external trigger input is used)
Connector BNC female
Level TTL

Gate output
Connector BNC female
Level TTL
**Option 4395A-010**

**Impedance measurement**

The following specifications are applied when the 43961A impedance test kit is connected to the 4395A.

### Measurement functions

- **Measurement parameters**
  - Z, Y, L, C, Q, R, X, G, B, θ

- **Display parameters**
  - IZI, 0_y, R, X, IYI, 0_x, G, B, IIΓI, 0_y, Γ_x, Γ_y, Cp, Cs, Lp, Ls, Rp, Rs, D, Q

### Display formats

- Vertical lin/log scale
- Complex plane
- Polar/Smith/admittance chart

### Sweep parameters

- Linear frequency sweep
- Logarithmic frequency sweep
- List frequency sweep
- Power sweep (in dBm unit)

### IF bandwidth

- 2, 10, 30, 100, 1k, 3k, 10k, 30k [Hz]

### Calibration

- OPEN/SHORT/LOAD 3 term calibration
- Fixture compensation
- Port extension correction

### Measurement port type

- 7-mm

### Output characteristics

- **Frequency range**
  - 100 kHz to 500 MHz

- **Frequency resolution**
  - 1 MHz

- **Output impedance**
  - 50 Ω nominal

- **Output level**
  - when the measurement port is terminated by 50 Ω
    - 56 to +9 dBm
  - when the measurement port is open
    - 0.71 mVrms to 1.26 Vrms

- **Resolution**
  - 0.1 dBm

- **Level accuracy**
  - ± (A + B + 6 x F/(1.8 x 10^9)) dB

Where

- A = 2 dB
- B = 0 dB (at 0 dBm ≤ P ≤ +15 dBm)
- or B = 1 dB (at –40 dBm ≤ P < 0 dBm)
- or B = 2 dB (at –50 dBm ≤ P < –40 dBm)

F is setting frequency [Hz], P is output power setting

---

1. When the measurement port is terminated with 50 Ω, the signal level at the measurement port is 6 dB lower than the signal level at the RF OUT port.
Measurement accuracy is specified at the connecting surface of the 7-mm connector of the Agilent 43961A under the following conditions:

- **Warm up time**: > 30 minutes
- **Ambient temperature**: 23 °C ± 5 °C, within ±1 °C from the temperature at which calibration is performed
- **Signal level (setting)**: 0 to +15 dBm
- **Correction**: ON
- **IFBW (for calibration and measurement)**: ≤ 300 Hz
- **Averaging factor (for calibration and measurement)**: ≥ 8

\[ Z_{\text{a}} = A + \left( \frac{B}{I_{Zm}I} + C \times I_{Zm}I \right) \times 100 \text{ [%]} \]

\[ \theta_{\text{a}} = \sin^{-1} \left( \frac{Z_{\text{a}}}{100} \right) \]

Where, \( I_{Zm}I \) is the measured impedance. A, B, and C are obtained from Figure 1-7.

\[ Y_{\text{a}} = A + \left( \frac{B}{I_{Ym}I} + C \times I_{Zm}I \right) \times 100 \text{ [%]} \]

\[ \theta_{\text{a}} = \sin^{-1} \left( \frac{Y_{\text{a}}}{100} \right) \]

Where, \( I_{Ym}I \) is the measured admittance. A, B, and C are obtained from Figure 1-7.
### R - X accuracy (depends on D)

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>$D \leq 0.2$</th>
<th>$0.2 &lt; D \leq 5$</th>
<th>$5 &lt; D$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_a$</td>
<td>$\pm X_m \times X_a / 100 [\Omega]$</td>
<td>$R_a / \cos \theta [%]$</td>
<td>$R_a [%]$</td>
</tr>
<tr>
<td>$X_a$</td>
<td>$X_a [%]$</td>
<td>$X_a / \sin \theta [%]$</td>
<td>$\pm R_m \times R_a / 100 [\Omega]$</td>
</tr>
</tbody>
</table>

Where,
- $D$ can be calculated as: $R/X$, or $R/(2\pi f \times L_s)$, or $R \times 2\pi f \times C_s$.
- $\theta$ can be calculated as: $\tan^{-1} (X/R)$, or $\tan^{-1} (2\pi f \times L_s / R)$, or $\tan^{-1} (1 / (R \times 2\pi f \times C_s))$.

$R_a = A + (B / R_m I + C \times I R_m I) \times 100 [%]$  
$X_a = A + (B / X_m I + C \times I X_m I) \times 100 [%]$  
$R_m$ and $X_m$ are the measured $R$ and $X$, respectively. $A$, $B$, and $C$ are obtained from Figure 1-7.

### G - B accuracy (depends on D)

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>$D \leq 0.2$</th>
<th>$0.2 &lt; D \leq 5$</th>
<th>$5 &lt; D$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$G_a$</td>
<td>$\pm B_m \times B_a / 100 [\Omega]$</td>
<td>$G_a / \cos \theta [%]$</td>
<td>$G_a [%]$</td>
</tr>
<tr>
<td>$B_a$</td>
<td>$B_a [%]$</td>
<td>$B_a / \sin \theta [%]$</td>
<td>$\pm G_m \times G_a / 100 [\Omega]$</td>
</tr>
</tbody>
</table>

Where,
- $D$ can be calculated as: $G/B$, or $G/(2\pi f \times C_p)$, or $G \times 2\pi f \times L_p$.
- $\theta$ can be calculated as: $\tan^{-1} (B/G)$, or $\tan^{-1} (2\pi f \times C_p / G)$, or $\tan^{-1} (1 / (G \times 2\pi f \times L_p))$.

$G_a = A + (B / G_m I + C \times I G_m I) \times 100 [%]$  
$B_a = A + (B / B_m I + C \times I B_m I) \times 100 [%]$  
$G_m$ and $B_m$ are the measured $G$ and $B$, respectively. $A$, $B$, and $C$ are obtained from Figure 1-7.

### D accuracy

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>$D \leq 0.2$</th>
<th>$0.2 &lt; D$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D_a$</td>
<td>$Z_a / 100$</td>
<td>$(Z_a / 100) \times (1 + D^2)$</td>
</tr>
</tbody>
</table>

Where, $Z_a$ is IZI accuracy.

### L accuracy (depends on D)

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>$D \leq 0.2$</th>
<th>$0.2 &lt; D$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L_a$</td>
<td>$L_a / 100$</td>
<td>$L_a (1 + D)$</td>
</tr>
</tbody>
</table>

Where, $L_a = A + (B / L_m I + C \times L_m I) \times 100 [%]$  
$IZI = 2\pi f \times L_m$, $f$ is frequency in Hz, and $L_m$ is measured $L$. $A$, $B$, and $C$ are obtained from Figure 1-7.

### C accuracy (depends on D)

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>$D \leq 0.2$</th>
<th>$0.2 &lt; D$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_a$</td>
<td>$C_a$</td>
<td>$C_a (1 + D)$</td>
</tr>
</tbody>
</table>

Where, $C_a = A + (B / C_m I + C \times C_m I) \times 100 [%]$  
$IZI = 2\pi f \times C_m$, $f$ is frequency in Hz, and $C_m$ is measured $C$. $A$, $B$, and $C$ are obtained from Figure 1-7.
Common to Network/Spectrum/Impedance Measurement

**Display**

- **Size/type**: 8.4 inch color LCD
- **Number of pixels**: 640 x 480
- **Effective display area**: 160 mm x 115 mm (600 x 430 dots)
- **Number of display channels**: 2

**Format single, dual (split or overwrite)**

- **Number of traces**
  - For measurement: 2 traces
  - For memory: 2 traces
- **Data math**
  - \( \text{gain} \times (\text{data} - \text{memory}) - \text{offset} \),
  - \( \text{gain} \times (\text{data} + \text{memory}) - \text{offset} \),
  - \( \text{gain} \times (\text{data} / \text{memory}) - \text{offset} \)
- **Data hold**: Maximum hold, minimum hold

**Marker**

- **Number of markers**
  - Main marker: 1 for each channel
  - Sub-marker: 7 for each channel
  - \( \Delta \) marker: 1 for each channel

**Hard copy**

- **Mode**: Dump mode only (including color dump mode)

**Storage**

- **Built-in flexible disk drive**
  - Type: 3.5 inch, 1.44 MByte, or 720 KByte,
  - 1.44 MByte format is used for disk initialization
- **Memory**: 512 KByte, can be backed up by flash memory

**GPIB**

- **Interface function**: SH1, AH1, T6, TEO, L4, LEO, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C4, C11, E2
- **Data transfer formats**: ASCII, 32 and 64 bit IEEE 754 floating point format, DOS PC format (32 bit IEEE with byte order reversed)

**Printer parallel port**

- **Interface**: IEEE 1284 Centronics standard compliant
- **Printer control language**: PCL3 printer control language
- **Connector**: D-SUB (25-pin)
Option 4395A-001 DC voltage/current source

The setting of Option 4395A-001 DC voltage/current source is independent of channel 1 and channel 2 settings.

Voltage

- **Range**: –40 V to +40 V
- **Resolution**: 1 mV
- **Current limitation**
  - at voltage setting = –25 V to +25 V: ±100 mA
  - at voltage setting = –40 V to –25 V, 25 V to 40 V: ±20 mA

Current

- **Range**: –20 µA to –100 mA, 20 µA to 100 mA
- **Resolution**: 20 µA
- **Voltage limitation**
  - at current setting = –20 mA to +20 mA: ±40 V
  - at current setting = –100 mA to –20 mA, 20 mA to 100 mA: ±25 V

Accuracy

- **Voltage** at 23 °C ± 5 °C: ±(0.1% + 4 mV + \( I_{dc} \cdot \Omega \) mV)
- **Current** at 23 °C ± 5 °C: ±(0.5% + 30 μA + \( V_{dc} / 10 \) mA)

Probe power
- **Output voltage**: +15 V (300 mA), –12.6 V (160 mA), GND nominal

Specifications when instrument BASIC is operated

- **Keyboard**: PS/2 style 101 English keyboard
- **Connector**: mini-DIN
- **8 bit I/O port**
  - **Connector**: D-SUB (15-pin)
  - **Level**: TTL
  - **Number of input/output bit**: 4 bit for input, 8 bit for output

**Figure 1-8. 8 bit I/O port pin assignments**

24-bit I/O interface

- **Connector**: D-SUB (36-pin)
- **Level**: TTL
- **I/O**: 8-bit for input or output, 16-bit for output

**Figure 1-9. 24-bit I/O interface pin assignment**

1. Current at DC source connector.
2. Voltage at DC source connector.
<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal name</th>
<th>Signal standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>0 V</td>
</tr>
<tr>
<td>2</td>
<td>INPUT1</td>
<td>TTL level, pulse input (pulse width: 1 µs or above)</td>
</tr>
<tr>
<td>3</td>
<td>OUTPUT1</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>4</td>
<td>OUTPUT2</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>5</td>
<td>OUTPUT PORT A0</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>6</td>
<td>OUTPUT PORT A1</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>7</td>
<td>OUTPUT PORT A2</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>8</td>
<td>OUTPUT PORT A3</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>9</td>
<td>OUTPUT PORT A4</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>10</td>
<td>OUTPUT PORT A5</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>11</td>
<td>OUTPUT PORT A6</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>12</td>
<td>OUTPUT PORT A7</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>13</td>
<td>OUTPUT PORT B0</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>14</td>
<td>OUTPUT PORT B1</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>15</td>
<td>OUTPUT PORT B2</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>16</td>
<td>OUTPUT PORT B3</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>17</td>
<td>OUTPUT PORT B4</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>18</td>
<td>OUTPUT PORT B5</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>19</td>
<td>OUTPUT PORT B6</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>20</td>
<td>OUTPUT PORT B7</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>21</td>
<td>I/O PORT C0</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>22</td>
<td>I/O PORT C1</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>23</td>
<td>I/O PORT C2</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>24</td>
<td>I/O PORT C3</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>25</td>
<td>I/O PORT D0</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>26</td>
<td>I/O PORT D1</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>27</td>
<td>I/O PORT D2</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>28</td>
<td>I/O PORT D3</td>
<td>TTL level, latch output</td>
</tr>
<tr>
<td>29</td>
<td>PORT C STATUS</td>
<td>TTL level, input mode: LOW, output mode: HIGH</td>
</tr>
<tr>
<td>30</td>
<td>PORT D STATUS</td>
<td>TTL level, input mode: LOW, output mode: HIGH</td>
</tr>
<tr>
<td>31</td>
<td>WRITE STROBE SIGNAL</td>
<td>TTL level, active low, pulse output (width: 10 µs; typical)</td>
</tr>
<tr>
<td>32</td>
<td>+5 V PULLUP</td>
<td>+5 V, 100 mA MAX</td>
</tr>
<tr>
<td>33</td>
<td>SWEEP END SIGNAL</td>
<td>TTL level, active low, pulse output (width: 20 µs; typical)</td>
</tr>
<tr>
<td>34</td>
<td>+5 V</td>
<td>+5 V, 100 mA MAX</td>
</tr>
<tr>
<td>35</td>
<td>PASS/FAIL SIGNAL</td>
<td>TTL level, PASS: HIGH, FAIL: LOW, latch output</td>
</tr>
<tr>
<td>36</td>
<td>PASS/FAIL WRITE STROBE SIGNAL</td>
<td>TTL level, active low, pulse output (width: 10 µs; typical)</td>
</tr>
</tbody>
</table>
General Characteristics

Input and output characteristics

External reference input
- Frequency: 10 MHz ± 100 Hz (SPC)
- Level: -5 dBm to +5 dBm (SPC)
- Input impedance: 50 Ω nominal
- Connector: BNC female

Internal reference output
- Frequency: 10 MHz nominal
- Level: 0 dBm (SPC)
- Output impedance: 50 Ω nominal
- Connector: BNC female

Reference oven output (Option 4395A-1D5)
- Frequency: 10 MHz nominal
- Level: 0 dBm (SPC)
- Output impedance: 50 Ω nominal
- Connector: BNC female

External trigger input
- Level: TTL
- Pulse width (Tp): ≥ 2 µs typically
- Polarity: positive/negative selective
- Connector: BNC female

External program Run/Cont input
- Connector: BNC female
- Level: TTL

Gate output (Option 4395A-1D6)
- Level: TTL
- Connector: BNC female

---

**Figure 1-10. Trigger signal (external trigger input)**
S-parameter test set interface

Connector .......................................................... D-SUB (25-pin)

Caution
Do not connect a printer to this connector. If you connect a printer with the S-parameter test set interface connector (TEST SET-I/0 INTERCONNECT), it may cause damage to the printer.

![S-parameter test set interface pin assignments](image)

External monitor output

Connector .......................................................... D-SUB (15-pin HD)
Display resolution ...................................................... 640 x 480 VGA

Operation conditions

Temperature
Disk drive non-operating condition .................................. 0 °C to 40 °C
Disk drive operating condition ...................................... 10 °C to 40 °C

Humidity
at wet bulb temperature ≤ 29 °C, without condensation
Disk drive non-operating condition .................................. 15% to 95% RH
Disk drive operating condition ...................................... 15% to 80% RH

Altitude ................................................................. 0 to 2,000 m
Warm up time .......................................................... 30 minutes

Non-operation conditions

Temperature ............................................................ -20 °C to 60 °C

Humidity
at wet bulb temperature ≤ 45 °C, without condensation ............ 15% to 95% RH

Altitude ................................................................. 0 to 4,572 m

Others

EMC ................................................................. Complies with CISPR 11 (1990) / EN 55011(1991) : Group 1, Class A
Complies with EN 50082-1 (1992) / IEC 1000-4-2 (1995) : 4 kV CD, 8 kV AD
Complies with EN 50082-1 (1992) / IEC 801-3 (1984) : 3 V/m
Complies with EN 50082-1 (1992) / IEC 1000-4-4 (1995) : 1 kV / Main, 0.5kV / Signal line
Complies with IEC 1000-3-3 (1994) / EN 61000-3-3 (1995)

Certified by CSA-C22.2 No.1010.1-92

Power requirements .................................................. .90 V to 132 V, or 198 V to 264 V (automatically switched),
47 to 63 Hz, 300 VA max.

Weight ................................................................. 21 kg (SPC)

Dimensions ............................................................ 425 (W) x 235 (H) x 553 (D) mm
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<thead>
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<th>Phone or Fax</th>
<th>United States:</th>
<th>(tel) 800 452 4844</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(tel) 877 884 4414</td>
<td>(fax) 905 282 6495</td>
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</tr>
<tr>
<td></td>
<td>(tel) (81) 426 56 7832</td>
<td>(fax) (81) 426 56 7840</td>
</tr>
</tbody>
</table>

| Korea: | (tel) (82 2) 2004 5004 | (fax) (82 2) 2004 5115 |
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